



NEWS AND VIEWS OF THIS KILN DRYING BUSINESS

The Problem: Have you been experiencing wood fabrication troubles in the spring when the factory switches from winter heating to opening of windows?

The Remedy:

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A change in moisture standards for the kiln-drying operation may be the remedy. Whether troubles due to moisture changes during fabrication are a problem or not, it is good practice to check on the moisture content of the wood during various stages of the manufacturing process.

How To Find Moisture Content

To determine the moisture content of wood by the oven-drying method, all that is needed is a saw, a good scale, and a reliable oven. The saw is needed to cut a *specimen* for oven drying from a sample board selected for moisture analysis. The scale is needed to weigh the specimen immediately after cutting. A good oven is essential if a true oven-dry weight is to be obtained.

The moisture content of wood as a percentage of the oven-dry weight is determined by dividing the weight of the water evaporated in oven drying by the oven-dry weight of the specimen and then multiplying this value by 100. The arithmetic used is:

$$\text{Moisture content in \% of} = \frac{\text{Original wt.} - \text{oven-dry wt.}}{\text{Oven-dry weight}} \times 100$$

To obtain accurate moisture content tests a few precautions are necessary. (1) The specimen cut from the sample selected for analysis should be about 1-in. along the grain. Wafer-thin specimens are sometimes cut because they dry out much more quickly in the oven; but errors in moisture determination are apt to be appreciable with such specimens, particularly on stock that is wet. The wafer technique is not recommended as good practice. (2) The 1-in. moisture section should be cut with a sharp saw. If the saw is dull, the wood might be heated and errors introduced by evaporation before the section can be weighed. (3) After the moisture section is cut, the loose slivers should be trimmed off

quickly, as large areas of end-grain wood have been exposed and evaporation of water from the end grain is rapid. (4) The specimen is then weighed, preferably on a scale that registers the weight in grams, and is sensitive to 0.1 gram. A triple-beam balance or a small torsion scale is suitable for this weighing process. Scales calibrated in grams are best suited because the decimal system can then be used in the calculation. If the weight is determined in pounds and ounces, the weight should be converted to the decimal equivalents.

After the moisture section is cut, trimmed, and weighed, it is ready for oven-drying. Oven-drying means heating the specimen at 212° F. to 220° F. (100° C. to 105° C.) until it reaches constant weight. If temperatures above 220° F. are used to hasten oven-drying, some wood substance may be destroyed, causing an error. If temperatures less than 212° F. are used, the time to dry to constant weight will be extended and perhaps all of the water may not be evaporated.

Ovens may be heated with steam or electricity. The latter type is most popular. In either case, good temperature control and reliability are essential. The electric oven should be located or housed in such a way that fire hazards are reduced to a minimum. The oven should be capable of 24-hour, 7-day operation without attendance. Most ovens in use are of the gravity type; but, if a considerable number of specimens are dried daily, a forced-air circulation oven may be needed.

Check the weights of the specimens in the oven occasionally. When constant weight is indicated, weigh them on the same scale as previously. Do it quickly. Remove only a few specimens from the oven at a time.

The next step is the moisture content calculation as the original weight and oven-dry weights are known. If a specimen had an original weight of 46.7 grams and the oven-dry weight was 44.3 grams, the moisture content

would be 5.4 percent of the oven-dry weight, calculated in three steps as follows:

1. Subtract the oven-dry weight from the original weight:
 $46.7 - 44.3 = 2.4$ grams
2. Divide the difference by the oven-dry weight:
 $2.4 \div 44.3 = 0.054$
3. Multiply the quotient by 100:
 $0.054 \times 100 = 5.4$ percent

If you use a slide rule for making these calculations, the equation is modified to simplify the manipulation of the rule as follows:

$$\text{Moisture content in percent of} = \left(\frac{\text{Original weight}}{\text{Oven-dry weight}} - 1 \right) \times 100$$

How to Interpret Tests

Here's a suggestion on how moisture tests taken in the plant are interpreted in diagnosing trouble. Select 10 representative samples of wood parts at some particular stage of processing where trouble seems to develop. Make the moisture tests as just outlined. Calculate the average moisture content of the 10 tests, (add the 10 values and divide by 10). If the average is less than 5.3 percent the stock is probably too dry and moisture regain is causing the trouble. If the average is greater than 6.7 percent, the trouble may be due to drying. If the average is between 5.3 and 6.7, some other cause for trouble must be sought. Perhaps the stock isn't uniformly dried. This is detected by determining the range or the difference between the driest and wettest of the 10 moisture tests. If the range or difference is greater than 4.1, the stock is not sufficiently uniform in dryness and the trouble may be due to either the wet or the dry pieces.

Dimensional stability during fabrication and during subsequent use of the product is a moisture control problem. Make moisture tests often. Use the spot-check system of 10 moisture tests to check the average and uniformity of dryness. Fabrication troubles caused by moisture regain can be avoided this spring by increasing the standard for the average.

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